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Earth Science Information: Planning for the Integration and Use of Global Change Information

SEMIANNUAL STATUS REPORT

January 1, 1992 - June 30, 1992

Submitted by:

The Consortium for International Earth Science Information Network

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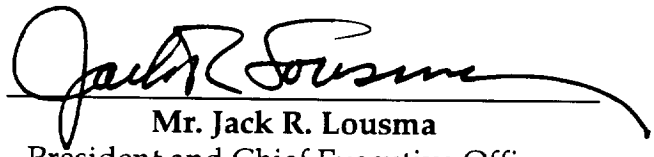
APPROVAL



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The technical activities CIESIN has conducted through the first six months of its NASA Grant program for FY 1992 continue to address the Congressional and NASA mandates established in 1990. CIESIN study efforts to date have been guided by Congressional mandates to *"convene key present and potential users to assess the need for investment in integration of earth science information,"* to *"outline the desirable pattern of interaction with the scientific and policy community,"* and to *"develop recommendations and draft plans to achieve the appropriate level of effort in the use of earth science data for research and public policy purposes."* In addition, CIESIN was tasked by NASA to develop plans for a Human Dimensions Data Center that would extend the benefits of the Earth Observing System Data and Information System (EOSDIS) to the users of global change information related to human dimensions issues both in the United States and internationally.

Activities and accomplishments of the first six months of CIESIN's 1992 technical program have focused on four main missions:

- Develop and implement plans for initiation of the **Socioeconomic Data and Applications Center** (SEDAC) as part of the EOSDIS Program.
- Pursue and develop a broad-based **global change Information Cooperative** by providing systems analysis and integration between natural science and social science data bases held by numerous federal agencies and other sources.
- Foster **scientific research into the human dimensions of global change** and provide integration between natural science and social science data and information.
- Serve as a **gateway for global change data and information distribution** through development of the Global Change Research Information Office and other comprehensive knowledge sharing systems.

NASA Study Grant Tasks

This report describes the current set of tasks that have been designed to meet the study mandates of NASA under Study Grant NAGW-2901. This program has recently grown into CIESIN's current work efforts with EPA, USDA, and DOD, and it forms the basis for recent initiatives such as the Global Change Research Information Office. CIESIN is using these tasks to develop the technical skills necessary to identify and support the global change user community, acquire the necessary information management and integration tools, and begin forming the interrelationships and networks that will enable CIESIN to become a gateway to EOSDIS data and services. The six tasks are as follows:

Task 1 - User needs analysis, support, and training;

Task 2 - Global change data and information resource development;

Task 3 - Information systems infrastructure development;

Task 4 - Integrated science programs;

Task 5 - Integrating mechanisms; and

Task 6 - Knowledge transfer.

TASK 1: User Needs Analysis and Services

Support of the global change user communities (our customers) requires that CIESIN meet several objectives. This includes identification and analysis of individual groups to understand their needs relative to the types and formats of data, the degree to which the data have been transformed, and the level of analysis needed to understand and use the resultant information. It also includes providing the appropriate training to help the user identify sources of data and how they can be accessed. Finally, CIESIN must provide follow-up on its products and services to assess and assure their continued operation and effectiveness. As global change data and information products are developed and become ready for implementation, we will support the user groups with consulting, product testing, order processing, installation, training, quality control, and follow-up service.

CIESIN User Analysis activities will establish and maintain user contact, order processing, consulting, and training. During 1992, user needs analysis and services will continue to interact with previously identified user groups and intensively focus on the identification of new groups. Accomplishments during the 1992 semiannual reporting period include the following:

Users Working Group/Workshops. The process to form a Users Working Group was recently initiated by identifying candidate members and a membership structure. Candidates are being contacted for attendance at CIESIN's November 16-18 Information Cooperative Workshop.

User Requirements Analysis. The user needs analysis task has resulted in the preparation of a memo report on an initial CIESIN User Model, including a compendium of user needs analyses to date. A Program Plan for addressing needs of Information Cooperative members has been incorporated in the CIESIN strategic planning process. A prototype user needs analysis is being prepared as part of the Saginaw River Valley/Great Lakes Watershed Project for the USEPA. The Congressional Report (draft, in preparation) provides an analysis of the needs of federal agencies and committees.

User Services and Training. The CIESIN Information Cooperative has implemented interactions, including data exchange, between the Agency for Toxic Substances and Disease Registry (ATSDR) and EROS Data Center.

EOSDIS Workshops. Interactions with EOSDIS working groups has included recent attendance at the meeting in Sioux Falls, SD.

TASK 2: Data and Information Resource Development

Activities within the CIESIN Data and Information Resource Development task are based on meeting two major objectives. The first is to develop and support the dissemination of global change data and information resources to the wide variety of user groups identified by the interdisciplinary networks and user needs analysis. The second is to develop appropriate information technologies that will support access to the integration and analysis of data resources. This could include the identification and acquisition of predictive models useful to CIESIN in the context of interdisciplinary networks, identification and acquisition of data integration tools (such as GIS) required to support DIS functionality, and identification and acquisition of a predictive capability to enable scientific collaboration related to global change.

The immediate goal is to establish a presence in world as the cornerstone of a unique Information Cooperative. The objective is to build a data and information center, populate it, through cooperative agreements and partnerships, with the appropriate global change data bases, and provide users the products and services needed for research, education, and decision making. Accomplishments during the 1992 semiannual reporting period include the following:

EOSDIS Interactions. CIESIN completed a structure for a team that will support the identification, acquisition, and maintenance of a SEDAC resource base. The team will identify of domain coordinator functions and prepare the V(0) Data and Information Resources Plan.

Extant Resources Analysis. A revised draft of the CIESIN Data Plan is in preparation. The Data Plan is being integrated with the CIESIN Science Data Plan. Extant resource analysis will be coordinated with Science by Domain Coordinators that reflect the structure of Social Process Diagram (see Task 4). Domain Coordinators will focus on the fields of policy and political systems, health effects, land use, demographics, agricultural capacity, economics, energy use/industrial metabolism, and earth processes/remote sensing. Analysis of resources in health and demographics was conducted by the International Social Science Council (ISSC); a report on economics is in preparation.

CIESIN has begun evaluating and prototyping regional data sets which represent the integration of Earth Science and human dimensions data (e.g., Saginaw Valley Regional project).

Global Environmental Directory Services. A prototype global environmental change directory is being developed. This prototype is designed to be interoperable with users of human dimensions data and to bring this arena into the EOSDIS (IMS interoperability).

Working closely with IWGDMGC, CIESIN has provided access to the InfoServer prototype, which is a new directed task. Earlier this year, an initial interoperability demonstration of the prototype directory services was conducted.

Information Cooperative Development. An Information Cooperative Development Plan has been drafted. Information Cooperative Memoranda of Understandings with CDC, WHO, EDC, NCDC, ATSDR have been developed and several have been implemented. Others (e.g., WRI, FAO, ICPSR) are in the formative stage .

Data Acquisition. A tracking data base containing 850 candidate entries has been developed. We also began an archival service for science investigator data sets, including data sets developed from pilot projects.

Pathfinder Development. Relative to domain specific data, CIESIN has identified some data sets that are particularly important (e.g., CIR, land use) or are considered "at risk." Regional pathfinders (e.g., Saginaw Valley Watershed; China) are also in development. A project for global databases has been initiated at University of California - Santa Barbara.

TASK 3: Information Systems Infrastructure

The function of the data and information resource development process, managed under CIESIN Operations, is to operate the systems (computers and networks) required to provide reliable services to CIESIN user groups on a round-the-clock basis. CIESIN intends to establish and maintain a cutting-edge capability in the information systems needed to identify, access, interpret, manage, and distribute data and information on global change. Moreover, the services provided will be accessible, user-friendly, and reliable.

CIESIN is establishing in Saginaw a testbed Data and Information System (DIS) capability in 1992. The DIS will house the organization's computing, networking, and information access functions and will house and support CIESIN core staff in the science and knowledge sharing programs. The DIS will be the *hub* of a CIESIN network and of CIESIN's distributed computing and database environment. CIESIN's operational responsibilities as the SEDAC -- CIESIN's *affiliation* with the NASA EOSDIS program -- will fall within the information systems infrastructure. Accomplishments during the 1992 semiannual reporting period include the following:

EOSDIS Network Engineering. A draft EOSDIS Networking Engineering Assessment Implementation Plan has been prepared.

CIESIN DIS System Engineering. A data and information system design document for testbed effort, which describes the basic capability and functionality of the facility, has been prepared and is being implemented. Internet communications with our Washington office and consortium members have also been established.

CIESIN DIS System Development. A prototype of the collaboratory testbed is in operation; a demonstration was conducted at CIESIN's Open House on October 9.

Applications Support. The computation server with support software, file server with support software, and visualization and media lab have been initiated. The Index and Introductory Packet, prepared CIESIN global environmental directory services prototype, describes how to use material and system architecture. In addition, SEDAC and GCRIO products and services guides were prepared. The CIESIN Resource Directory has been replaced by the Information Server (see Task 2).

TASK 4: Science Programs

Although CIESIN is a user-driven organization, its reputation, credibility, and respectability of its products and services will be judged by its scientific underpinnings. CIESIN will engage in science from the point of view that the science CIESIN performs will be driven by the needs of its users: scientists, policy makers, resource managers, educators, and the general public.

Objectives of the CIESIN Science Program include: (1) Support the human dimensions element of the USGCRP; (2) Participate in developing the international research agenda for the Human Dimensions of Global Environmental Change Program (HDP); (3) Promote research efforts that will provide enriched data in priority areas, such as land use and demography; (4) Help determine requirements for the DIS, including data requirements, predictive models, and knowledge sharing services; and (5) Establish recognition for CIESIN as a forum for development of the human dimensions program through selected conferences and workshops.

Accomplishments during the 1992 semiannual reporting period include the following:

Science Advisory Committee. The CIESIN Science Department has identified a second iteration of a prospective Science Advisory Committee (SAC). This process has been guided largely by our external consultants, Professor Billie Turner of Clark University, Professor Richard Rockwell of the University of Michigan, Professor Bill Clark of the Kennedy School of Government at Harvard University, and Dr. Paul Stern of the National Research Council. The choice to enlist four consultants to the Science Department was made in part to ensure that the Science Advisory Committee was optimally and objectively chosen, particularly with regard to representation from appropriate disciplines in the social sciences.

We expect to hold our first meeting in November 1992 in Saginaw. Each meeting of the Science Advisory Committee will result in a meeting report, including their recommendations and any other concerns. The report will be directed to the President of CIESIN with a copy provided to CIESIN's funding sponsors.

Conferences and Workshops. CIESIN has begun early plans for a Global Change Institute to be held in Michigan in 1993 that will address one of the four points of our science program.

Interdisciplinary Networks Coordination. The concept of "interdisciplinary networks" is being replaced, with the advice of our consultants, by the concept of

focused scientific thrusts in the same areas of the human dimensions of global change that were earlier identified as candidate IN's. These are (1) land-use (2) demography and (3) industrial/agricultural metabolism. The initial meeting of the SAC will endeavor to sharpen these definitions.

Preparation has begun on the Science Data Plan, which identifies special human dimensions of global change topics, to be coordinated with CIESIN DIS Data Plan (Task 2) and SEDAC Domain Coordinators.

Human Dimensions Program. Leaders of the Human Dimensions of Global Environmental Change program of the ISSC have suggested that CIESIN serve as the Data and Information System for that Program, and a Memorandum of Understanding that would implement this connection is now under preparation (Global Change Work Plan).

Pathways to Understanding: The Interactions of Humanity and Global Environmental Change. was written and published.

Science Projects. An analysis of the nine Pilot Projects was completed, and a preliminary Pilot Project assessment study was drafted. CIESIN is conducting a review of the assessment report to determine an appropriate method of publication and dissemination of individual study reports.

Technical reports describing the results and findings of the Global Change Science Research Activities are expected to be produced by mid-December 1992.

TASK 5: Integrating Mechanisms

A principal objective within CIESIN is to develop in-house data integrating mechanisms, including the identification and acquisition of predictive models useful to CIESIN in the context of interdisciplinary networks, identification and acquisition of data integration tools (such as GIS) required to support DIS functionality, and identification and acquisition of a predictive capability to enable scientific collaboration related to global change.

Accomplishments during the 1992 semiannual reporting period include the following:

Model Development. Funding has been provided to the University of Geneva to continue development of the Luterbacher Predictive Model through February 1993.

Data and Information Management. The study of data formats has been completed. A data holdings prototype (InfoServer, see Task 2) is in preparation.

Collaboration Technology. Global/Regional Modeling Frameworks are being developed in three areas: (1) decision support systems, (2) parallel computing, and (3) heterogeneous data systems. A draft advanced information technology (AIT)

report, Science Processing Library (SPL) report, and a series of technical articles are in preparation.

Directory Services Development. We are continuing development of the CIESIN Distributed Metadata Directory System. Major accomplishments include: (1) porting the server components to new platforms, (2) prototyping of a PC/Windows-based client, and (3) via the addition of an SQL database interface, the creation of an interoperability bridge to the Global Change Master Directory System. which is interoperable with NASA Master Directory server.

An evaluation of standard data transfer formats (HDF, NetCDF, etc.) was conducted, and Internet-based information servers like WAIS, Gopher, WorldWideWeb, and Archie have been assessed. To test the system, we began data integration and analysis capability modeling (GRASS, Saginaw Valley Watershed Study). Drafts of the Distributed Metadata Directory System Architecture report and the Format Evaluation Report were also completed.

TASK 6: Knowledge Transfer

Under the Knowledge Transfer task, CIESIN is developing a process that transforms identified user needs and integrated information systems into efficient mechanisms for the transfer of global change information in the form and content most readily usable. To organize this effort, CIESIN has divided Knowledge Transfer into seven major programmatic categories: products and services, education and training, policy, international users and research, resource managers, public information and education, and science and technology. Accomplishments during the 1992 semiannual reporting period include the following:

Education and Training. A Windows *on Global Change* Design Report was prepared. We also began evaluation of a multimedia delivery system to educators in K-12 that will integrate EOSDIS data (GSV, WOGC, AAAS efforts). Completed Earth station installations for the Global Student Village (GSV) project were completed, and initial student training began in Thailand and Brazil.

Policy. Several reports supporting the Congressional Study effort are in preparation.

International Users and Technology. CIESIN began drafting an implementation plan for the Global Change Research Information Office. We also sponsored the recent UN/ISY Conference in Boulder, Colorado.

Other Government Agency Interactions

Other federal agencies involved in the U.S. Global Change Research Program are likely to become major "users" of EOSDIS and CIESIN data and information resources. For example, socioeconomic databases may be used directly by scientific researchers, and more

developed global change information may be used by policy makers and applications users (resource managers) within federal agencies.

Since its inception, CIESIN has worked closely with government agencies, particularly with agency decision makers and scientists. Government representatives have participated in CIESIN-sponsored conferences and have helped identify appropriate agency programs that collect or archive data on global environmental change.

CIESIN is currently involved in the analysis of data types, formats, availability, quality, and accessibility with the Department of Agriculture, Department of Defense, and Environmental Protection Agency. CIESIN is providing a mechanism for applied users to get information about EOS and is identifying information resources within the organizations that are pertinent to global change. CIESIN intends to continue active participation with these and other agencies to meet its mission objectives.

Facilities Development

The interim CIESIN Headquarters was recently completed, with full building occupancy by early 1993. Selection of a site for the permanent facility on Ojibway Island in Saginaw, Michigan was recently announced. The program statement and pre-design phases of the permanent facility have been documented. Environmental assessment and architectural design (schematic design, design development, and construction documents) of the proposed facility have been delayed due to rescission of funds.